

#18

SEQUENCE LISTING

<110> WATANABE, Eijiro  
OEDA, Kenji

<120> Raffinose Synthase Genes and Their Use

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<140> 08/992,914

<141> 1997-12-18

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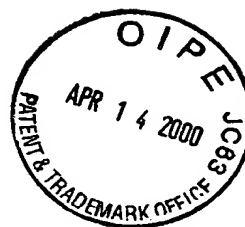
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Cys Gly Tyr Trp Gly Gly Val Arg Pro Gly Val His Gly Met Pro Lys 355 360 365		
Ala Arg Val Val Val Pro Lys Val Ser Gln Gly Leu Lys Met Thr Met 370 375 380		
Glu Asp Leu Ala Val Asp Lys Ile Val Glu Asn Gly Val Gly Leu Val 385 390 395 400		
Pro Pro Asp Phe Ala His Glu Met Phe Asp Gly Leu His Ser His Leu 405 410 415		
Glu Ser Ala Gly Ile Asp Gly Val Lys Val Asp Val Ile His Leu Leu 420 425 430		
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 Tyr Phe Phe Lys Glu Lys Lys Leu Arg Leu Met Lys Cys Ser Asp Arg  
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Ile Ala Ser Met Glu His Cys Asn Asp Phe Phe Leu Leu Gly Thr Glu	
450 455 460	
gcc ata gcc ctt ggg cgc gta gga gat gat ttt tgg tgc act gat ccc	1501
Ala Ile Ala Leu Gly Arg Val Gly Asp Asp Phe Trp Cys Thr Asp Pro	
465 470 475 480	
tct gga gat cca aat ggc acg tat tgg ctc caa ggg tgt cac atg gtg	1549
Ser Gly Asp Pro Asn Gly Thr Tyr Trp Leu Gln Gly Cys His Met Val	
485 490 495	
cac tgt gcc tac aac agc ttg tgg atg ggg aat ttt att cag ccg gat	1597
His Cys Ala Tyr Asn Ser Leu Trp Met Gly Asn Phe Ile Gln Pro Asp	
500 505 510	
tgg gac atg ttc cag tcc act cac cct tgt gcc gaa ttc cat gcg gcc	1645
Trp Asp Met Phe Gln Ser Thr His Pro Cys Ala Glu Phe His Ala Ala	
515 520 525	
tct agg gcc atc tct ggt gga cca gtt tac gtt agt gat tgt gtt gga	1693
Ser Arg Ala Ile Ser Gly Gly Pro Val Tyr Val Ser Asp Cys Val Gly	
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aag cac aac ttc aag ttg ctc aag agc ctc gct ttg cct gat ggg acg	1741
Lys His Asn Phe Lys Leu Leu Lys Ser Leu Ala Leu Pro Asp Gly Thr	
545 550 555 560	
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Ile Leu Arg Cys Gln His Tyr Ala Leu Pro Thr Arg Asp Cys Leu Phe	
565 570 575	
gaa gac ccc ttg cat gat ggg aag aca atg ctc aaa att tgg aat ctc	1837
Glu Asp Pro Leu His Asp Gly Lys Thr Met Leu Lys Ile Trp Asn Leu	
580 585 590	
aac aaa tat aca ggt gtt ttg ggt cta ttt aat tgc caa gga ggt ggg	1885
Asn Lys Tyr Thr Gly Val Leu Gly Leu Phe Asn Cys Gln Gly Gly Gly	
595 600 605	
tgg tgt ccc gta act agg aga aac aag agt gcc tct gaa ttt tca caa	1933
Trp Cys Pro Val Thr Arg Arg Asn Lys Ser Ala Ser Glu Phe Ser Gln	
610 615 620	
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Thr Val Thr Cys Leu Ala Ser Pro Gln Asp Ile Glu Trp Ser Asn Gly	
625 630 635 640	
aaa agc cca ata tgc ata aaa ggg atg aat gtg ttt gct gta tat ttg	2029
Lys Ser Pro Ile Cys Ile Lys Gly Met Asn Val Phe Ala Val Tyr Leu	
645 650 655	
ttc aag gac cac aaa cta aag ctc atg aag gca tca gag aaa ttg gaa	2077
Phe Lys Asp His Lys Leu Lys Leu Met Lys Ala Ser Glu Lys Leu Glu	
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gtt tca ctt gag cca ttt act ttt gag cta ttg aca gtg tct cca gtg	2125
Val Ser Leu Glu Pro Phe Thr Phe Glu Leu Leu Thr Val Ser Pro Val	
675 680 685	
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Ile Val Leu Ser Lys Lys Leu Ile Gln Phe Ala Pro Ile Gly Leu Val	
690 695 700	
aac atg ctt aac act ggt ggt gcc att cag tcc atg gag ttt gac aac	2221
Asn Met Leu Asn Thr Gly Gly Ala Ile Gln Ser Ser Met Glu Phe Asp Asn	
705 710 715 720	
cac ata gat gtg gtc aaa att ggg gtt agg ggt tgt ggg gag atg aag	2269
His Ile Asp Val Val Lys Ile Gly Val Arg Gly Cys Gly Glu Met Lys	
725 730 735	
gtg ttt gca tca gag aaa cca gtt agt tgc aaa cta gat ggg gta gtt	2317
Val Phe Ala Ser Glu Lys Pro Val Ser Cys Lys Leu Asp Gly Val Val	
740 745 750	
gta aaa ttt gat tat gag gat aaa atg ctg aga gtg caa gtt ccc tgg	2365
Val Lys Phe Asp Tyr Glu Asp Lys Met Leu Arg Val Gln Val Pro Trp	
755 760 765	
cct agt gct tca aaa ttg tca atg gtt gag ttt tta ttt tgatccctga	2414
Pro Ser Ala Ser Lys Leu Ser Met Val Glu Phe Leu Phe	
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2498

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Leu Ala Asn Gly His Pro Phe Leu Thr Glu Val Pro Glu Asn Ile Ile  
35 40 45

Val Thr Pro Ser Pro Ile Asp Ala Lys Ser Ser Lys Asn Asn Glu Asp  
50 55 60

Asp Asp Val Val Gly Cys Phe Val Gly Phe His Ala Asp Glu Pro Arg  
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Ser Arg His Val Ala Ser Leu Gly Lys Leu Arg Gly Ile Lys Phe Met  
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Ser Ile Phe Arg Phe Lys Val Trp Trp Thr Thr His Trp Val Gly Ser  
100 105 110

Asn Gly His Glu Leu Glu His Glu Thr Gln Met Met Leu Leu Asp Lys  
115 120 125

Asn Asp Gln Leu Gly Arg Pro Phe Val Leu Ile Leu Pro Ile Leu Gln  
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Ala Ser Phe Arg Ala Ser Leu Gln Pro Gly Leu Asp Asp Tyr Val Asp  
145 150 155 160

Val Cys Met Glu Ser Gly Ser Thr Arg Val Cys Gly Ser Ser Phe Gly  
165 170 175

Ser Cys Leu Tyr Val His Val Gly His Asp Pro Tyr Gln Leu Leu Arg  
180 185 190

Glu Ala Thr Lys Val Val Arg Met His Leu Gly Thr Phe Lys Leu Leu  
195 200 205

Glu Glu Lys Thr Ala Pro Val Ile Ile Asp Lys Phe Gly Trp Cys Thr  
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Trp Asp Ala Phe Tyr Leu Lys Val His Pro Ser Gly Val Trp Glu Gly  
225 230 235 240

Val Lys Gly Leu Val Glu Gly Gly Cys Pro Pro Gly Met Val Leu Ile  
245 250 255

Asp Asp Gly Trp Gln Ala Ile Cys His Asp Glu Asp Pro Ile Thr Asp  
260 265 270

Gln Glu Gly Met Lys Arg Thr Ser Ala Gly Glu Gln Met Pro Cys Arg  
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 Lys Asp Ser Glu Lys Gly Met Gly Ala Phe Val Arg Asp Leu Lys Glu  
 305 310 315 320  
 Gln Phe Arg Ser Val Glu Gln Val Tyr Val Trp His Ala Leu Cys Gly  
 325 330 335  
 Tyr Trp Gly Gly Val Arg Pro Lys Val Pro Gly Met Pro Gln Ala Lys  
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 Val Val Thr Pro Lys Leu Ser Asn Gly Leu Lys Leu Thr Met Lys Asp  
 355 360 365  
 Leu Ala Val Asp Lys Ile Val Ser Asn Gly Val Gly Leu Val Pro Pro  
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 His Leu Ala His Leu Leu Tyr Glu Gly Leu His Ser Arg Leu Glu Ser  
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 Ala Gly Ile Asp Gly Val Lys Val Asp Val Ile His Leu Leu Glu Met  
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 Lys Ala Leu Thr Ala Ser Val Lys Lys His Phe Lys Gly Asn Gly Val  
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 Ile Ala Ser Met Glu His Cys Asn Asp Phe Phe Leu Leu Gly Thr Glu  
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 Ala Ile Ala Leu Gly Arg Val Gly Asp Asp Phe Trp Cys Thr Asp Pro  
 465 470 475 480  
 Ser Gly Asp Pro Asn Gly Thr Tyr Trp Leu Gln Gly Cys His Met Val  
 485 490 495  
 His Cys Ala Tyr Asn Ser Leu Trp Met Gly Asn Phe Ile Gln Pro Asp  
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 Trp Asp Met Phe Gln Ser Thr His Pro Cys Ala Glu Phe His Ala Ala  
 515 520 525  
 Ser Arg Ala Ile Ser Gly Gly Pro Val Tyr Val Ser Asp Cys Val Gly  
 530 535 540  
 Lys His Asn Phe Lys Leu Leu Lys Ser Leu Ala Leu Pro Asp Gly Thr  
 545 550 555 560  
 Ile Leu Arg Cys Gln His Tyr Ala Leu Pro Thr Arg Asp Cys Leu Phe  
 565 570 575  
 Glu Asp Pro Leu His Asp Gly Lys Thr Met Leu Lys Ile Trp Asn Leu  
 580 585 590  
 Asn Lys Tyr Thr Gly Val Leu Gly Leu Phe Asn Cys Gln Gly Gly Gly

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Lys Ser Pro Ile Cys Ile Lys Gly Met Asn Val Phe Ala Val Tyr Leu 645 650 655		
Phe Lys Asp His Lys Leu Lys Leu Met Lys Ala Ser Glu Lys Leu Glu 660 665 670		
Val Ser Leu Glu Pro Phe Thr Phe Glu Leu Leu Thr Val Ser Pro Val 675 680 685		
Ile Val Leu Ser Lys Lys Leu Ile Gln Phe Ala Pro Ile Gly Leu Val 690 695 700		
Asn Met Leu Asn Thr Gly Gly Ala Ile Gln Ser Met Glu Phe Asp Asn 705 710 715 720		
His Ile Asp Val Val Lys Ile Gly Val Arg Gly Cys Gly Glu Met Lys 725 730 735		
Val Phe Ala Ser Glu Lys Pro Val Ser Cys Lys Leu Asp Gly Val Val 740 745 750		
Val Lys Phe Asp Tyr Glu Asp Lys Met Leu Arg Val Gln Val Pro Trp 755 760 765		
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aag tcc gac gac agg ccc tac atc gtg ctg ctt ccg ctc atc gag ggg 97  
 Lys Ser Asp Asp Arg Pro Tyr Ile Val Leu Leu Pro Leu Ile Glu Gly  
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cag ttt cgg gct tcc ctt cag ccc ggt gtg gat gat ttt atc gat att 145  
 Gln Phe Arg Ala Ser Leu Gln Pro Gly Val Asp Asp Phe Ile Asp Ile  
 35 40 45

tgt gtc gaa agc ggg tca acc aag gtc aac gag tcc tcg ttc cgt gct 193  
 Cys Val Glu Ser Gly Ser Thr Lys Val Asn Glu Ser Ser Phe Arg Ala  
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tcg ctc tac atg cac gcc ggt gat gac cct ttt acc ctg gtg aag gac	241
Ser Leu Tyr Met His Ala Gly Asp Asp Pro Phe Thr Leu Val Lys Asp	
65 70 75 80	
gcc gtg aag gtg gcg cgc cac cac ctc ggg acg ttc agg ctg ctg gag	289
Ala Val Lys Val Ala Arg His His Leu Gly Thr Phe Arg Leu Leu Glu	
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gag aaa act ccg ccg ggg atc gtc gac aaa ttc ggg tgg tgc acg tgg	337
Glu Lys Thr Pro Pro Gly Ile Val Asp Lys Phe Gly Trp Cys Thr Trp	
100 105 110	
gat gcg ttc tac ctc aac gtc cag ccc cac ggc gtt atg gag ggc gtg	385
Asp Ala Phe Tyr Leu Asn Val Gln Pro His Gly Val Met Glu Gly Val	
115 120 125	
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Gln Gly Leu Val Asp Gly Gly Cys Pro Pro Gly Leu Val Leu Ile Asp	
130 135 140	
gac ggg tgg cag tcc att tgt cac gac aac gac gcg ctc acc acc gag	481
Asp Gly Trp Gln Ser Ile Cys His Asp Asn Asp Ala Leu Thr Thr Glu	
145 150 155 160	
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Gly Met Gly Arg Thr Ser Ala Gly Glu Gln Met Pro Cys Arg Leu Ile	
165 170 175	
aag ttt gag gag aat tac aag ttc agg gag tac gag agc ccg aat aaa	577
Lys Phe Glu Glu Asn Tyr Lys Phe Arg Glu Tyr Glu Ser Pro Asn Lys	
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act ggg ccg ggc ccg aat acg ggg atg ggg gcc ttt att cgt gac atg	625
Thr Gly Pro Gly Pro Asn Thr Gly Met Gly Ala Phe Ile Arg Asp Met	
195 200 205	
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Lys Asp Asn Phe Lys Ser Val Asp Tyr Val Tyr Val Trp His Ala Leu	
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Cys Gly Tyr Trp Gly Gly Leu Arg Pro Asn Val Pro Gly Leu Pro Glu	
225 230 235 240	
gct aag ctc att gag ccc aaa ctg act cct ggg ctt aag acc acc atg	769
Ala Lys Leu Ile Glu Pro Lys Leu Thr Pro Gly Leu Lys Thr Thr Met	
245 250 255	
gaa gat ttg gct gtt gat aag att gtc aac aat ggc gtg ggt ctg gtc	817
Glu Asp Leu Ala Val Asp Lys Ile Val Asn Asn Gly Val Gly Leu Val	
260 265 270	
cca ccg gag ttt gtt gaa caa atg tat gaa gga tta cat tca cat ctc	865
Pro Pro Glu Phe Val Glu Gln Met Tyr Glu Gly Leu His Ser His Leu	
275 280 285	
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Glu Ser Val Gly Ile Asp Gly Val Lys Val Asp Val Ile His Leu Leu	
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Tyr Tyr Lys Ala Leu Ser Ser Ser Val Asn Asn His Phe Asn Gly Asn	
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Gly Val Ile Ala Gly Leu Glu His Cys Asn Asp Phe Met Phe Leu Gly	
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acc gag gcc att acc ttg ggt cgt gtc ggg gat gat ttt tgg tgc act	1105
Thr Glu Ala Ile Thr Leu Gly Arg Val Gly Asp Asp Phe Trp Cys Thr	
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Asp Pro Ser Gly Asp Pro Asn Gly Thr Phe Trp Leu Gln Gly Cys His	
370 375 380	
atg gtg cac tgc gcc tac aac agc ata tgg atg ggt aat ttc atc cac	1201
Met Val His Cys Ala Tyr Asn Ser Ile Trp Met Gly Asn Phe Ile His	
385 390 395 400	
cct gat tgg gac atg ttt caa tcg act cac cct tgc gct gaa ttc cac	1249
Pro Asp Trp Asp Met Phe Gln Ser Thr His Pro Cys Ala Glu Phe His	
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gct gcc tca cga gcc atc tcc ggc ggg ccc att tac gtc agt gac tcg	1297
Ala Ala Ser Arg Ala Ile Ser Gly Gly Pro Ile Tyr Val Ser Asp Ser	
420 425 430	
gtc gga aag cac aac ttc gag ctc ctt agg agc ctc gtt ctt ccc gat	1345
Val Gly Lys His Asn Phe Glu Leu Leu Arg Ser Leu Val Leu Pro Asp	
435 440 445	
ggc tcc atc ctc cgt tgt gat tac tac gcg ctt ccg act cgc gat tgc	1393
Gly Ser Ile Leu Arg Cys Asp Tyr Tyr Ala Leu Pro Thr Arg Asp Cys	
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ctc ttt gaa gat cca ctt cac aat ggc aag act atg ctc aaa att tgg	1441
Leu Phe Glu Asp Pro Leu His Asn Gly Lys Thr Met Leu Lys Ile Trp	
465 470 475 480	
aat tat aac aag ttc acc gga gtt gtc gga act ttc aac tgc caa ggt	1489
Asn Tyr Asn Lys Phe Thr Gly Val Val Gly Thr Phe Asn Cys Gln Gly	
485 490 495	
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Gly Gly Trp Ser Arg Glu Val Arg Arg Asn Gln Cys Ala Ala Glu Tyr	
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tcc cac gcc gtc tcc tct agc gct ggt ccg agt gac att gag tgg aag	1585
Ser His Ala Val Ser Ser Ser Ala Gly Pro Ser Asp Ile Glu Trp Lys	
515 520 525	
caa gga acg agt ccg atc gac gtc gac ggc gtc aaa aca ttc gcg ttg	1633
Gln Gly Thr Ser Pro Ile Asp Val Asp Gly Val Lys Thr Phe Ala Leu	
530 535 540	
tac cta ttc cac gag aag aaa ctc gtc ctt tct aag cca tca gac aaa	1681

Tyr Leu Phe His Glu Lys Lys Leu Val Leu Ser Lys Pro Ser Asp Lys  
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atc gac atc acg ctt gag ccc ttc gat ttt gag ctg ata acc gtt tct 1729  
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Gln Phe Arg Ala Ser Leu Gln Pro Gly Val Asp Asp Phe Ile Asp Ile  
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Cys Val Glu Ser Gly Ser Thr Lys Val Asn Glu Ser Ser Phe Arg Ala  
 50 55 60

Ser Leu Tyr Met His Ala Gly Asp Asp Pro Phe Thr Leu Val Lys Asp  
 65 70 75 80

Ala Val Lys Val Ala Arg His His Leu Gly Thr Phe Arg Leu Leu Glu  
 85 90 95

Glu Lys Thr Pro Pro Gly Ile Val Asp Lys Phe Gly Trp Cys Thr Trp  
 100 105 110

Asp Ala Phe Tyr Leu Asn Val Gln Pro His Gly Val Met Glu Gly Val  
 115 120 125

Gln Gly Leu Val Asp Gly Gly Cys Pro Pro Gly Leu Val Leu Ile Asp  
 130 135 140

Asp Gly Trp Gln Ser Ile Cys His Asp Asn Asp Ala Leu Thr Thr Glu  
 145 150 155 160

Gly Met Gly Arg Thr Ser Ala Gly Glu Gln Met Pro Cys Arg Leu Ile  
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Lys Phe Glu Glu Asn Tyr Lys Phe Arg Glu Tyr Glu Ser Pro Asn Lys  
 180 185 190

Thr Gly Pro Gly Pro Asn Thr Gly Met Gly Ala Phe Ile Arg Asp Met  
 195 200 205

Lys Asp Asn Phe Lys Ser Val Asp Tyr Val Tyr Val Trp His Ala Leu  
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Cys Gly Tyr Trp Gly Gly Leu Arg Pro Asn Val Pro Gly Leu Pro Glu



225		230		235		240
Ala Lys Leu Ile Glu	Pro Lys Leu Thr	Pro Gly Leu Lys Thr	Thr Met			
	245	250	255			
Glu Asp Leu Ala Val	Asp Lys Ile Val	Asn Asn Gly Val	Gly Leu Val			
	260	265	270			
Pro Pro Glu Phe Val	Glu Gln Met Tyr	Glu Gly Leu His	Ser His Leu			
	275	280	285			
Glu Ser Val Gly Ile	Asp Gly Val Lys	Val Asp Val Ile	His Leu Leu			
	290	295	300			
Glu Met Leu Cys Glu	Asp Tyr Gly Gly	Arg Val Asp Leu	Ala Lys Ala			
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Tyr Tyr Lys Ala Leu	Ser Ser Ser Val	Asn Asn His Phe	Asn Gly Asn			
	325	330	335			
Gly Val Ile Ala Gly	Leu Glu His Cys	Asn Asp Phe Met	Phe Leu Gly			
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Thr Glu Ala Ile Thr	Leu Gly Arg Val	Gly Asp Asp Phe	Trp Cys Thr			
	355	360	365			
Asp Pro Ser Gly Asp	Pro Asn Gly Thr	Phe Trp Leu Gln	Gly Cys His			
	370	375	380			
Met Val His Cys Ala	Tyr Asn Ser Ile	Trp Met Gly Asn	Phe Ile His			
385	390	395	400			
Pro Asp Trp Asp Met	Phe Gln Ser Thr	His Pro Cys Ala	Glu Phe His			
	405	410	415			
Ala Ala Ser Arg Ala	Ile Ser Gly Gly	Pro Ile Tyr Val	Ser Asp Ser			
	420	425	430			
Val Gly Lys His Asn	Phe Glu Leu Leu	Arg Ser Leu Val	Leu Pro Asp			
	435	440	445			
Gly Ser Ile Leu Arg	Cys Asp Tyr Tyr	Ala Leu Pro Thr	Arg Asp Cys			
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Leu Phe Glu Asp Pro	Leu His Asn Gly	Lys Thr Met Leu	Lys Ile Trp			
465	470	475	480			
Asn Tyr Asn Lys Phe	Thr Gly Val Val	Gly Thr Phe Asn	Cys Gln Gly			
	485	490	495			
Gly Gly Trp Ser Arg	Glu Val Arg Arg	Asn Gln Cys Ala	Ala Glu Tyr			
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Ser His Ala Val Ser	Ser Ser Ala Gly	Pro Ser Asp Ile	Glu Trp Lys			
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Gln Gly Thr Ser Pro	Ile Asp Val Asp	Gly Val Lys Thr	Phe Ala Leu			
	530	535	540			
Tyr Leu Phe His Glu	Lys Lys Leu Val	Leu Ser Lys Pro	Ser Asp Lys			
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Ser Gly Gly Pro Ile Tyr Val Ser Asp Ser Val Gly Gln His Asp Phe  
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gcg ctg ctc cgc cgc ctg gcg ctc ccc gac ggc acc gtc ctc cgg tgc 145  
Ala Leu Leu Arg Arg Leu Ala Leu Pro Asp Gly Thr Val Leu Arg Cys  
35 40 45

gag ggc cac gcg ctg ccc acg cgc gac tgc ctc ttc gcc gac ccg ctc 193  
Glu Gly His Ala Leu Pro Thr Arg Asp Cys Leu Phe Ala Asp Pro Leu  
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cac gac ggc cgg acc gtg ctc aag atc tgg aac gtg aac cgc ttc gcc 241  
His Asp Gly Arg Thr Val Leu Lys Ile Trp Asn Val Asn Arg Phe Ala  
65 70 75 80

ggc gtc gtc ggc gcc ttc aac tgc cag ggc ggc ggg tgg agc ccc gag 289  
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85 90 95

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Ala Arg Arg Asn Lys Cys Phe Ser Glu Phe Ser Val Pro Leu Ala Ala  
100 105 110

cgc gcc tcg ccg tcc gac gtc gag tgg aag agc ggc aag gcg ggg cca 385  
Arg Ala Ser Pro Ser Asp Val Glu Trp Lys Ser Gly Lys Ala Gly Pro  
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Gly Val Ser Val Lys Asp Val Ser Gln Phe Ala Val Tyr Ala Val Glu  
130 135 140

gcc agg acg ctg cag ctg ctg cgc ccc gac gag ggc gtc gac ctc acg 481  
Ala Arg Thr Leu Gln Leu Leu Arg Pro Asp Glu Gly Val Asp Leu Thr  
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165 170 175

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Ile Ser His Glu Arg Ala Ile Lys Phe Ala Pro Ile Gly Leu Ala Asn	
180 185 190	
atg ctc aac acc gcc ggc gcc gtg cag gcg ttc gag gcc aag aaa gat	625
Met Leu Asn Thr Ala Gly Ala Val Gln Ala Phe Glu Ala Lys Lys Asp	
195 200 205	
gct agc ggc gtc acg gca gag gtg ttc gtg aag ggc gca ggg gag ctg	673
Ala Ser Gly Val Thr Ala Glu Val Phe Val Lys Gly Ala Gly Glu Leu	
210 215 220	
gtg gcg tac tgc tgc gcg acg ccc agg ctc tgc aag gtg aac ggc gac	721
Val Ala Tyr Ser Ser Ala Thr Pro Arg Leu Cys Lys Val Asn Gly Asp	
225 230 235 240	
gag gcc gag ttc acg tac aag gac ggc gtg gtc acc gtc gac gtg ccg	769
Glu Ala Glu Phe Thr Tyr Lys Asp Gly Val Val Thr Val Asp Val Pro	
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Trp Ser Gly Ser Ser Ser Lys Leu Cys Cys Val Gln Tyr Val Tyr	
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Glu Gly His Ala Leu Pro Thr Arg Asp Cys Leu Phe Ala Asp Pro Leu	
50 55 60	
His Asp Gly Arg Thr Val Leu Lys Ile Trp Asn Val Asn Arg Phe Ala	
65 70 75 80	
Gly Val Val Gly Ala Phe Asn Cys Gln Gly Gly Gly Trp Ser Pro Glu	
85 90 95	
Ala Arg Arg Asn Lys Cys Phe Ser Glu Phe Ser Val Pro Leu Ala Ala	
100 105 110	
Arg Ala Ser Pro Ser Asp Val Glu Trp Lys Ser Gly Lys Ala Gly Pro	
115 120 125	

Gly	Val	Ser	Val	Lys	Asp	Val	Ser	Gln	Phe	Ala	Val	Tyr	Ala	Val	Glu
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Ala	Arg	Thr	Leu	Gln	Leu	Leu	Arg	Pro	Asp	Glu	Gly	Val	Asp	Leu	Thr
145				150						155					160
Leu	Gln	Pro	Phe	Thr	Tyr	Glu	Leu	Phe	Val	Val	Ala	Pro	Val	Arg	Val
			165						170					175	
Ile	Ser	His	Glu	Arg	Ala	Ile	Lys	Phe	Ala	Pro	Ile	Gly	Leu	Ala	Asn
			180					185					190		
Met	Leu	Asn	Thr	Ala	Gly	Ala	Val	Gln	Ala	Phe	Glu	Ala	Lys	Lys	Asp
		195					200					205			
Ala	Ser	Gly	Val	Thr	Ala	Glu	Val	Phe	Val	Lys	Gly	Ala	Gly	Glu	Leu
	210					215					220				
Val	Ala	Tyr	Ser	Ser	Ala	Thr	Pro	Arg	Leu	Cys	Lys	Val	Asn	Gly	Asp
225					230					235					240
Glu	Ala	Glu	Phe	Thr	Tyr	Lys	Asp	Gly	Val	Val	Thr	Val	Asp	Val	Pro
				245					250					255	
Trp	Ser	Gly	Ser	Ser	Ser	Lys	Leu	Cys	Cys	Val	Gln	Tyr	Val	Tyr	
			260					265					270		

<210> 9  
 <211> 30  
 <212> DNA  
 <213> Artificial Sequence

<220>  
 <223> Description of Artificial Sequence:synthetic  
 primer 1 (from list 1)

<400> 9  
 aattttcaag catagccaag ttaaccacct

30

<210> 10  
 <211> 24  
 <212> DNA  
 <213> Artificial Sequence

<220>  
 <223> Description of Artificial Sequence:synthetic  
 primer 2 (from list 1)

<400> 10  
 gtcacaaga taatgatggtt agtc

24

<210> 11  
 <211> 22  
 <212> DNA  
 <213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer 3 (from list 1)

<400> 11  
atacaagtga ggaacttgac ca 22

<210> 12  
<211> 24  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:synthetic  
primer 4 (from list 1)

<400> 12  
ccaaaccata gcaaacctaa gcac 24

<210> 13  
<211> 28  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:synthetic  
primer 5 (from list 1)

<400> 13  
acaacagaaa aatatgactc ttattact 28

<210> 14  
<211> 26  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:synthetic  
primer 6 (from list 1)

<400> 14  
aaaagagagt caaacatcat agtatc 26

<210> 15  
<211> 29  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:synthetic  
primer 1 (from list 2)

<400> 15  
atggcaccac caagcataac caaaactgc 29

<210> 16  
<211> 43

<212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
       primer 2 (from list 2)  
  
 <400> 16  
 atggcaccac caagcataac caaaactgca accctccaag acg 43  
  
  
 <210> 17  
 <211> 25  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
       primer 3 (from list 2)  
  
 <400> 17  
 tcaaaataaa aactggacca aagac 25  
  
  
 <210> 18  
 <211> 30  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
       primer 4 (from list 2)  
  
 <400> 18  
 tcaaaataaa aactggacca aagacaatgt 30  
  
  
 <210> 19  
 <211> 25  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
       primer 5 (from list 2)  
  
 <400> 19  
 atggctccaa gcataagcaa aactg 25  
  
  
 <210> 20  
 <211> 32  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
       primer 6 (from list 2)  
  
 <400> 20  
 atggctccaa gcataagcaa aactgtggaa ct 32

<210> 21  
<211> 25  
<212> DNA  
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer 7 (from list 2)

<400> 21  
tcaaaataaa aactcaacca ttgac

25

<210> 22  
<211> 39  
<212> DNA  
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer 8 (from list 2)

<400> 22  
tcaaaataaa aactcaacca ttgacaattt tgaagcact

39

<210> 23  
<211> 20  
<212> PRT  
<213> Vicia faba

<400> 23

Gly Ile Lys Phe Met Ser Ile Phe Arg Phe Lys Val Trp Trp Thr Thr  
1 5 10 15

His Trp Val Gly  
20

<210> 24  
<211> 14  
<212> PRT  
<213> Vicia faba

<400> 24

Ile Ile Asp Lys Phe Gly Trp Cys Thr Trp Asp Ala Phe Tyr  
1 5 10

<210> 25  
<211> 15  
<212> PRT  
<213> Vicia faba

<400> 25

Gly Gly Cys Pro Pro Gly Phe Val Ile Ile Asp Asp Gly Trp Gln  
1 5 10 15

<210> 26  
<211> 17  
<212> PRT  
<213> Vicia faba

<400> 26  
Thr Ser Ala Gly Glu Gln Met Pro Cys Arg Leu Val Lys Tyr Glu Glu  
1 5 10 15

Asn

<210> 27  
<211> 16  
<212> PRT  
<213> Vicia faba

<400> 27  
Val Tyr Val Trp His Ala Leu Cys Gly Tyr Trp Gly Gly Val Arg Pro  
1 5 10 15

<210> 28  
<211> 20  
<212> PRT  
<213> Vicia faba

<400> 28  
Thr Met Glu Asp Leu Ala Val Asp Lys Ile Val Glu Asn Gly Val Gly  
1 5 10 15

Leu Val Pro Pro  
20

<210> 29  
<211> 23  
<212> PRT  
<213> Vicia faba

<400> 29  
Gly Leu His Ser His Leu Glu Ser Ala Gly Ile Asp Gly Val Lys Val  
1 5 10 15

Asp Val Ile His Leu Leu Glu  
20

<210> 30  
<211> 14  
<212> PRT  
<213> Vicia faba

<400> 30  
Gly Gly Arg Val Glu Leu Ala Arg Ala Tyr Tyr Lys Ala Leu  
1 5 10

<210> 31  
<211> 12



<212> PRT  
<213> Vicia faba

<400> 31  
Val Lys Lys His Phe Lys Gly Asn Gly Val Ile Ala  
1 5 10

<210> 32  
<211> 46  
<212> PRT  
<213> Vicia faba

<400> 32  
Glu His Cys Asn Asp Phe Phe Leu Leu Gly Thr Glu Ala Ile Ser Leu  
1 5 10 15  
Gly Arg Val Gly Asp Asp Phe Trp Cys Ser Asp Pro Ser Gly Asp Pro  
20 25 30  
Asn Gly Thr Tyr Trp Leu Gln Gly Cys His Met Val His Cys  
35 40 45

<210> 33  
<211> 43  
<212> PRT  
<213> Vicia faba

<400> 33  
Ala Tyr Asn Ser Leu Trp Met Gly Asn Phe Ile Gln Pro Asp Trp Asp  
1 5 10 15  
Met Phe Gln Ser Thr His Pro Cys Ala Glu Phe His Ala Ala Ser Arg  
20 25 30  
Ala Ile Ser Gly Gly Pro Ile Tyr Val Ser Asp  
35 40

<210> 34  
<211> 9  
<212> PRT  
<213> Vicia faba

<400> 34  
Leu Pro Asp Gly Ser Ile Leu Arg Cys  
1 5

<210> 35  
<211> 24  
<212> PRT  
<213> Vicia faba

<400> 35  
Ala Leu Pro Thr Arg Asp Cys Leu Phe Glu Asp Pro Leu His Asn Gly  
1 5 10 15  
Lys Thr Met Leu Lys Ile Trp Asn  
20

<210> 36  
<211> 13  
<212> PRT  
<213> Vicia faba

<400> 36  
Gly Val Leu Gly Leu Phe Asn Cys Gln Gly Gly Gly Trp  
1 5 10

<210> 37  
<211> 9  
<212> PRT  
<213> Vicia faba

<400> 37  
Phe Ala Pro Ile Gly Leu Val Asn Met  
1 5

<210> 38  
<211> 32  
<212> DNA  
<213> Artificial Sequence

<220>  
<221> modified\_base  
<222> (1)..(32)  
<223> n = inosine

<220>  
<223> Description of Artificial Sequence:synthetic  
primer 1-F (from list 4)

<400> 38  
ttnaangtnt ggtggacnac ncantgggtn gg

32

<210> 39  
<211> 41  
<212> DNA  
<213> Artificial Sequence

<220>  
<221> modified\_base  
<222> (1)..(41)  
<223> n = inosine

<220>  
<223> Description of Artificial Sequence:synthetic  
primer 2-F (from list 4)

<400> 39  
atnatngana anttnggntg gtgnacntgg gangcntnt a

41

<210> 40  
<211> 41  
<212> DNA

<213> Artificial Sequence

<220>

<221> modified\_base

<222> (1)..(41)

<223> n = inosine

<220>

<223> Description of Artificial Sequence:synthetic  
primer 2-RV (from list 4)

<400> 40

tanaangcnt cccangtnca ccancnaa n ttntcnatna t

41

<210> 41

<211> 44

<212> DNA

<213> Artificial Sequence

<220>

<221> modified\_base

<222> (1)..(44)

<223> n = inosine

<220>

<223> Description of Artificial Sequence:synthetic  
primer 3-F (from list 4)

<400> 41

ggnggntgnc cncnggntt ngtnatnatn gangangnt ggca

44

<210> 42

<211> 44

<212> DNA

<213> Artificial Sequence

<220>

<221> modified\_base

<222> (1)..(44)

<223> n = inosine

<220>

<223> Description of Artificial Sequence:synthetic  
primer 3-RV (from list 4)

<400> 42

tgccancnt cntcnatnat nacnaancn ggnggncanc cncc

44

<210> 43

<211> 32

<212> DNA

<213> Artificial Sequence

<220>

<221> modified\_base

<222> (1)..(32)

<223> n = inosine

<220>

<223> Description of Artificial Sequence:synthetic  
primer 4-F (from list 4)

<400> 43

aanaancant tnaanggnaa nggngtnatn gc

32

<210> 44

<211> 32

<212> DNA

<213> Artificial Sequence

<220>

<221> modified\_base

<222> (1)..(32)

<223> n = inosine

<220>

<223> Description of Artificial Sequence:synthetic  
primer 4-RV (from list 4)

<400> 44

gcnatnacnc cnttnccntt naantgnttn tt

32

<210> 45

<211> 38

<212> DNA

<213> Artificial Sequence

<220>

<221> modified\_base

<222> (1)..(38)

<223> n = inosine

<220>

<223> Description of Artificial Sequence:synthetic  
primer 5-F (from list 4)

<400> 45

tggatgggna anttnatnca nccngantgg ganatggt

38

<210> 46

<211> 38

<212> DNA

<213> Artificial Sequence

<220>

<221> modified\_base

<222> (1)..(38)

<223> n = inosine

<220>

<223> Description of Artificial Sequence:synthetic  
primer 5-RV (from list 4)

<400> 46

aacatntccc antcnggntg natnaanttn cccatcca

38

<210> 47  
<211> 27  
<212> DNA  
<213> Artificial Sequence

<220>  
<221> modified\_base  
<222> (1)..(27)  
<223> n = inosine

<220>  
<223> Description of Artificial Sequence:synthetic  
primer 6-RV (from list 4)

<400> 47  
catnttnacn arnccnatng gngcnaa

27

<210> 48  
<211> 26  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:synthetic  
primer 8.2 (from list 5)

<400> 48  
aaraacngcnc cnagyathat hgacaa

26

<210> 49  
<211> 20  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:synthetic  
primer 13.4 (from list 5)

<400> 49  
aarathtgga ayctnaacaa

20

<210> 50  
<211> 24  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:synthetic  
primer 7.4 (from list 5)

<400> 50  
aargcnagrg tngtngtncc naag

24

<210> 51  
<211> 21  
<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer 13.3RV (from list 5)

<400> 51

yttrttnagr ttccadattt t

21

<210> 52

<211> 21

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer 10.3RV (from list 5)

<400> 52

yttrtcytc tanagraatt t

21

<210> 53

<211> 30

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer RES-2RV (from list 6)

<400> 53

ggctgagggt cggttcattc ctgaatcatc

30

<210> 54

<211> 30

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer RS-7 (from list 6)

<400> 54

ccaaatggta catattggct ccaaggttg

30

<210> 55

<211> 30

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer RS-8 (from list 6)

<400> 55

aagagtgtat ctgaattttc acgcgcggtg

30

<210> 56  
 <211> 30  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
       primer RS-9 (from list 6)  
  
 <400> 56  
 tgggtgcaatg ggaaaactcc aatgagcacc 30  
  
 <210> 57  
 <211> 30  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
       primer RS-10 (from list 6)  
  
 <400> 57  
 atgaagtgtt ctgatatagatt gaaagtttcg 30  
  
 <210> 58  
 <211> 30  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
       primer RS-11 (from list 6)  
  
 <400> 58  
 cagtctctgg agtttgatga taatgcaagt 30  
  
 <210> 59  
 <211> 41  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
       primer RS-N (from list 7)  
  
 <400> 59  
 cgcgatcca ccatggcacc accaagcata accaaaactg c 41  
  
 <210> 60  
 <211> 37  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
       primer RS-C (from list 7)

<220>  
 <221> modified\_base  
 <222> (1)..(37)  
 <223> n = inosine  
  
 <400> 60  
 tgctctagat tatcaaaata aaaactggac caaagac

37

<210> 61  
 <211> 35  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
 primer 1-F (from list 8)

<220>  
 <221> modified\_base  
 <222> (1)..(35)  
 <223> n= inosine  
  
 <400> 61  
 cgattnaang tntggtggac nacncantgg gtngg

35

<210> 62  
 <211> 45  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
 primer 2-RV (from list 8)

<220>  
 <221> modified\_base  
 <222> (1)..(45)  
 <223> n = inosine  
  
 <400> 62  
 ggcctanaan gcntccang tncaccancc naantntcn atnat

45

<210> 63  
 <211> 41  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
 primer 5-F (from list 8)

<220>  
 <221> modified\_base  
 <222> (1)..(41)  
 <223> n = inosine  
  
 <400> 63



cgatggatgg gnaanttnat ncancngan tggganatgt t

41

<210> 64

<211> 32

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer 6-RV (from list 8)

<220>

<221> modified\_base

<222> (1)..(32)

<223> n = inosine

<400> 64

ggccacatnt tnacnarncc natngngn aa

32

<210> 65

<211> 30

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer SN-1 (from list 9)

<400> 65

cacgaactgg ggcacgagac acagatgatg

30

<210> 66

<211> 30

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer SC-3RV (from list 9)

<400> 66

aagcaagtca cggagtgtga atagtcagag

30

<210> 67

<211> 30

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer SC-5 (from list 9)

<400> 67

acacgagact gtttgtttga agacccttg

30

<210> 68

<211> 25  
<212> DNA  
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer SC-6 (from list 9)

<400> 68  
tggaatctca acaaataatac aggtg

25

<210> 69  
<211> 30  
<212> DNA  
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer SN-3RV (from list 9)

<400> 69  
gggtcatggc caacgtggac gtataagcac

30

<210> 70  
<211> 30  
<212> DNA  
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer SN-4RV (from list 9)

<400> 70  
gatgatcact ggcgcggttt tctcctcgag

30

<210> 71  
<211> 35  
<212> DNA  
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer 1-F (from list 10)

<220>

<221> modified\_base  
<222> (1)..(35)  
<223> n = inosine

<400> 71  
cgattnaang tntggtggac nacncantgg gtngg

35

<210> 72  
<211> 37  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:synthetic  
primer 4-RV (from list 10)

<220>  
<221> modified\_base  
<222> (1)..(37)  
<223> n = inosine

<400> 72  
ggccagcnat nacncnttn ccnttnaant gnttntt

37

<210> 73  
<211> 44  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:synthetic  
primer 2-F (from list 10)

<220>  
<221> modified\_base  
<222> (1)..(44)  
<223> n = inosine

<400> 73  
cgaatnatng anaanttngg ntggtgnacn tgggangcnt tnta

44

<210> 74  
<211> 32  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:synthetic  
primer 6-RV (from list 10)

<220>  
<221> modified\_base  
<222> (1)..(32)  
<223> n = inosine

<400> 74  
ggccacatnt tnacnarncc natngngnch aa

32

<210> 75  
<211> 41  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:synthetic  
primer 5-F (from list 11)

<220>  
<221> modified\_base  
<222> (1)..(41)

<223> n= inosine

<400> 75

cgatggatgg gnaanttnat ncancngan tggganatgt t

41

<210> 76

<211> 32

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer 6-RV (from list 11)

<220>

<221> modified\_base

<222> (1)..(32)

<223> n = inosine

<400> 76

ggccacatnt tnacnarncc natngngcn aa

32

<210> 77

<211> 25

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer M10 (from list 12)

<400> 77

gacgtcgagt ggaagagcgg caagg

25

<210> 78

<211> 25

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer M-11 (from list 12)

<400> 78

cacctacgag ctcttcgctg ttgcc

25

<210> 79

<211> 25

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence:synthetic  
primer BamSac-(+) (from list 13)

<400> 79

gatcgagctc gtgtcggatc cagct

25

<210> 80  
 <211> 17  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
       primer BamSac-(-) (from list 13)  
  
 <400> 80  
 ggatccgaca cgagctc 17  
  
 <210> 81  
 <211> 30  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
       primer 35S (from list 14)  
  
 <400> 81  
 ttccagtatg gacgattcaa ggcttgcttc 30  
  
 <210> 82  
 <211> 25  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
       primer NOS (from list 14)  
  
 <400> 82  
 atgtataatt gcgggactct aatca 25  
  
 <210> 83  
 <211> 30  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic  
       primer RS-F (from list 14)  
  
 <400> 83  
 aagagtgtat ctgaattttc acgcgcggtg 30  
  
 <210> 84  
 <211> 33  
 <212> DNA  
 <213> Artificial Sequence  
  
 <220>  
 <223> Description of Artificial Sequence:synthetic

primer RS-RV (from list 14)

<400> 84  
accttcccat acaccttttg gatgaacctt caa 33

<210> 85  
<211> 38  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:BamHI-NcoI  
linker (from Fig. 1)

<400> 85  
ggatccacca tggcaccacc aagcataacc aaaactgc 38

<210> 86  
<211> 36  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:XbaI-NotI-SacI  
linker (from Fig. 1)

<400> 86  
tgataatcta gagcggccgc caccgcggtg gagctc 36

<210> 87  
<211> 34  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Description of Artificial Sequence:XbaI-NotI-SacI  
linker (from Fig. 1)

<400> 87  
tctagattat caaaataaaa actggaccaa agac 34